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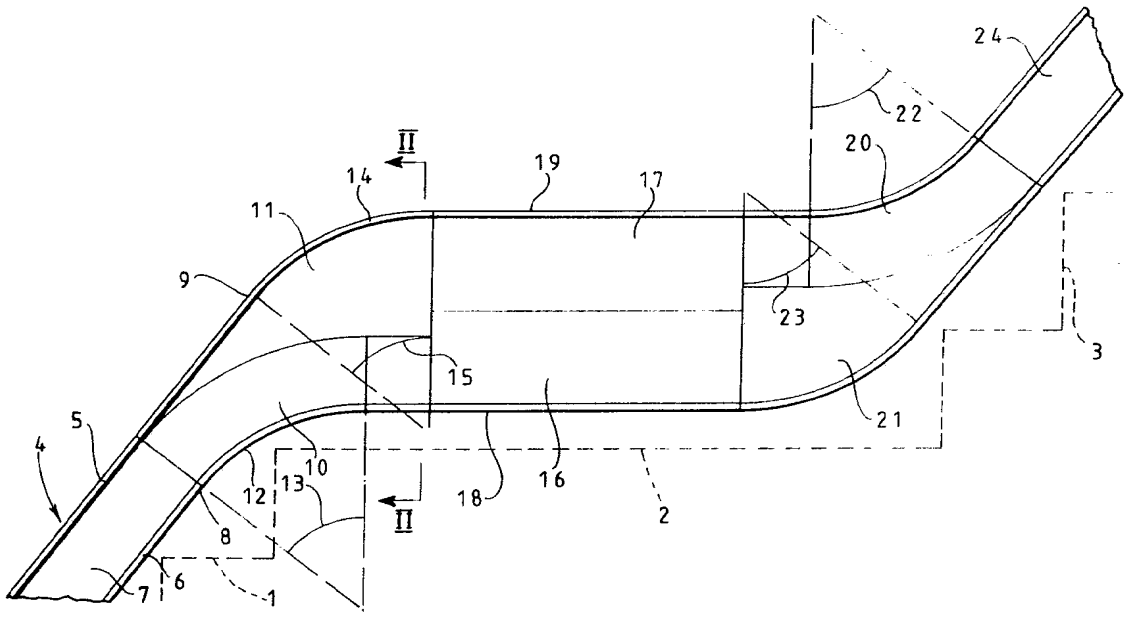

(57) Abstract

A stairlift comprises a chassis carried by a rail having inclined portions (4, 24) along flights of stairs (1, 3) and a horizontal portion (16 - 19) along a landing (2). These portions are connected by curved portions (9, 10, 11, 12, 14; 20, 21), each of which comprises an upper member with an upper curved transverse web (14) and a lower member with a lower curved transverse web (12). The horizontal and curved portions are formed from standard components selected or adjusted for the location of the stairlift.

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STAIRLIFT AND RAIL FOR STAIRLIFT.

The present invention relates to a stairlift and to a rail for a stairlift.

It is known to provide stairlifts for handicapped people who have difficulty in negotiating stairs, for instance in their homes. Such stairlifts generally comprise a rail which supports and guides a chassis having a chair or other support for a handicapped person. A typical rail has upper and lower transverse webs and a typical chassis has a plurality of rollers which guide movement of the chassis along the rail and prevent undesirable pivoting of the chassis so that the chassis remains upright and cannot pivot about a vertical axis with respect to the rail.

In many buildings, each flight of stairs from one floor to another is essentially straight, so that the rail may be straight and the chassis follows a linear inclined movement path between the top and bottom of the flight of stairs. However, it is also common for stairs between floors to be divided into two or more flights with a landing between adjacent flights. In some cases, the flights are aligned and substantially in a common vertical plane. In other cases, the flights make an angle, usually approximately 90°, with each other in a horizontal plane. Also, the angles of inclination of flights of stairs may vary from building to building, within one building, and even between adjacent floors of a building.

In order to provide a stairlift, capable of negotiating a plurality of flights of stairs, it is known to manufacture a stair rail specifically adapted to its intended location. Thus, the relative locations, angles

of inclination, and (where appropriate) relative horizontal dispositions of flights have to be determined with great accuracy and the rail has to be adapted so as to fit the specific location. This is a complex and time-consuming procedure, which makes such stairlifts expensive to manufacture and install. Further, as each rail is adapted to a specific location, a stairlift cannot be removed and relocated at another site without manufacturing a new rail adapted to the new site.

It is further necessary to manufacture the chassis so as to match each individual rail. In particular, the relative positions of rollers within the chassis are determined at least in part by the angle of inclination of flights of stairs. Again, this is relatively costly and inconvenient, and makes it difficult or impossible to adapt a chassis designed for one particular location to another location for use with a different rail.

According to a first aspect of the invention, there is provided a rail for a stairlift, comprising a first rail portion for guiding a chassis along a curved path having a first angle of inclination at a first end of the path and a second angle of inclination, different from the first angle of inclination, at a second end of the path, the first rail portion having an upper member attached to a lower member, the upper member having an upper curved transverse web and the lower member having a lower curved transverse web.

Preferably the curves of the upper and lower curved transverse webs are circular and subtend the same angle.

At least one of the upper and lower members may have a straight transverse web extending tangentially from one end of the respective curved transverse web.

The upper and lower members may have respective upright webs which are attached to each other, for instance by means of nuts and bolts in slotted holes to permit adjustment of relative position. Alternatively, the upper and lower curved transverse webs may be connected together by two upright webs.

The rail may further comprise a second rail portion having upper and lower webs extending linearly and tangentially from the upper and lower webs at the first end of the first rail portion. The rail may further comprise a third rail portion having upper and lower webs extending linearly and tangentially from the upper and lower webs at the second end of the first rail portion.

The second angle of inclination may be substantially equal to zero, for instance to provide a connection between an inclined flight of stairs and a substantially horizontal landing. In such a case, the third rail portion may comprise upper and lower members attached to each other. The upper and lower members of the third rail portion may have upright webs attached together, for instance by nuts and bolts in slots so as to permit the relative heights of the upper and lower webs to be adjusted. Alternatively, the upper and lower members of the third rail portion may be connected directly together or may be connected together by spacers. The third rail portion may be transversely curved, for instance so as to negotiate a bend in the stairs in a horizontal plane. The end of the third rail portion opposite the first rail portion may be connected to a fourth rail portion similar to the first rail portion but with the upper and lower members inverted so as to permit a fifth rail portion to follow another flight of stairs.

According to a second aspect of the invention, there is provided a stairlift comprising a rail according to the

first aspect of the invention and a chassis supported on and guided by the rail.

Preferably the chassis has at least one upper roller for rolling on the upper transverse web, at least one lower roller for rolling on the lower transverse web, and means for adjusting the relative heights of the upper and lower rollers.

Preferably the chassis has a toothed wheel cooperating with a rack on the rail for propelling the chassis along the rail. Preferably the toothed wheel is connected via reduction gearing to an electric motor, the chassis carries a rechargeable electric battery for powering the motor, and the chassis and the rail have contact means for cooperating with each other when the chassis is at a predetermined position on the rail to permit the supply of recharging current to the battery.

It is thus possible to provide a rail for a stairlift which can be made from standard components in order to fit any site. Linear sections of the rail are interconnected by members which may be formed, either to detailed designs or on site, so as to accommodate changes in inclination and horizontal curves. Removal and relocation at another site is possible and some or all of the parts of the rail may be reused. The rail can be readily adapted to any design of stairway without the need for complex, time-consuming, and expensive design and manufacturing procedures.

It is also possible to provide a stairlift which has all of these advantages. By providing means for adjusting the relative heights of rollers, a standard chassis may readily be adapted during manufacture or on site to a specific rail, and may be re-adjusted subsequently for use at a different location.

The invention will be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a side view of part of a rail constituting an embodiment of the invention;

Figure 2 is cross-sectional view on line II of Figure 1;

Figure 3 is a front view of a chassis of a stairlift constituting an embodiment of the invention for use on the rail of Figure 1;

Figures 4 and 5 are side views from opposite sides of the chassis of Figure 3;

Figure 6 is a side view of part of another rail constituting another embodiment of the invention;

Figure 7 shows an end profile of the part of the rail of Figure 6 in the direction VII;

Figure 8 is a side view of a horizontally curved part of a rail for use with the part shown in Figure 6;

Figure 9 is a side view of a horizontally straight part of a rail for use with the part shown in Figure 6 or Figure 8; and

Figure 10 is a front view of part of a chassis for use with the rail parts shown in Figures 6 to 9.

The stairlift rail shown in Figure 1 is for use on a stairway comprising a lower flight of stairs 1, a horizontal landing 2, and an upper flight of stairs 3, the stairs and landing being shown in broken lines. The rail comprises a lower inclined straight section 4 having

upper and lower transverse webs 5 and 6 interconnected by an upright web 7.

At the upper end of the rail section 4, the lower web is cut away above 8 whereas the upper web 5 and the upright web 7 extend as far as 9. The upper end of the section 4 is connected to a curved section formed by a lower member 10 and an upper member 11. The lower member 10 has a transverse web 12 with a curved portion subtending an angle 13. The lower web 6 of the rail section 4 merges tangentially into one end of the circularly curved portion of the web 12. At the other end of the curved portion, the web 12 extends linearly. The member 10 is formed, for instance, by extruding aluminium and then bending a portion of the resulting extrusion.

The upper member 11 comprises a curved transverse web 14 which is circular and subtends an angle 15 equal to the angle 13. The radii of curvature of the webs 12 and 14 are the same for all installations and are similar to but slightly different from each other. The upper web 5 abuts one end of the web 14 so as to be substantially tangential. The member 11 is also formed by extrusion and bending and is connected to the member 10, for instance by nuts and bolts in slotted holes.

The members 10 and 11 are made from standard components which are adapted to the actual location of the stairlift. Thus, the angles 13 and 15 are substantially equal to the angle of inclination to the horizontal of the rail section 4. The ends of the members 10 and 11 are trimmed so that the curved webs 12 and 14 subtend the correct angle, with the result that the right hand ends of the webs in Figure 1 are substantially horizontal.

The curved rail section formed by the members 10 and 11 is connected to a short straight rail section formed by

members 16 and 17. These members provide upper and lower transverse horizontal straight webs 18 and 19 which form horizontal continuations of the webs 12 and 14. The vertical distance between the webs 18 and 19 depends on the angle of inclination of the rail section 4, and the members 16 and 17 are connected together, for instance by nuts and bolts in slotted holes, so as to allow the height to be set to suit the installation.

The right hand end of the members 16 and 17 in Figure 1 is connected to members 20 and 21, which are substantially identical to the members 10 and 11, respectively. The members 20 and 21 have circularly curved transverse webs which subtend identical angles 22 and 23 which are equal to the angle of inclination of the upper flight 3. The upper ends of the members 20 and 21 are connected to a straight rail section 24 which is substantially identical to the rail section 4.

In order to fit the rail to a particular site, the rail sections 4 and 24 are cut to length and the inter-connecting rail sections are then formed, either on the basis of measurement or during installation, from prefabricated components. The ends of the rail sections 4 and 24 are cut to shape and the members 10, 11, 16, 17, 20, and 21 are trimmed so as to fit in the available space on the landing 2 and provide continuous smooth upper and lower webs for guiding a stairlift chassis.

Although the flights 1 and 3 of stairs shown in Figure 1 extend in substantially the same vertical plane, the rail can be adapted to stairways in which the adjacent flights are angled in a horizontal plane, for instance by 90 or 180°. In this case, only the members 16 and 17 need to be curved in a horizontal plane so as to guide the chassis around the landing between flights of stairs.

Figure 2 indicates the cross-sections of the members 10 and 11 and also shows the overlap of the vertical webs of these members. The fixing arrangements have been omitted for clarity. The members 16 and 17 have substantially the same cross-sections but the webs 18 and 19 are straight whereas the web 12 has a curved section and the web 14 is curved. Alternatively, the member 11 could extend to 8 and incorporate a straight portion of transverse web 14.

The stairlift chassis shown in Figures 3 to 5 comprises a plate 30 which is fixed to three brackets 31 to 33. Each of the brackets 31 to 33 is provided with means (not shown) for receiving and adjustably fixing three vertical struts 34 to 36, respectively. The lower ends of the struts 34 and 36 are interconnected by a cross member 37. An electric motor 38 and a gear box 39 are mounted on the frame formed by the struts 34 and 36 and the member 37 (the motor and gear box are not shown in Figures 4 and 5 for purposes of clarity). The chassis is shown in Figures 3 to 5 in place on a rail of the type shown in Figures 1 and 2. In Figure 3, the chassis is shown on a horizontal portion of the rail while, in Figures 4 and 5, the chassis is shown on an inclined rail section. The rail comprises a vertical web 40, an upper transverse web 41, a lower transverse web 42, and a rack 43. The rack is provided below the upper web 41 of the inclined rail section but, at the horizontal section where the distance between the webs 41 and 42 is greater, the rack 43 maintains a substantially constant height above the web 42. A toothed wheel 44 is attached to an output shaft 45 of the gear box 39 so that, when electrical power is supplied to the motor 38, the toothed wheel 44 rotates and co-operates with the rack 43 to drive the chassis along the rail.

The plate 30 is pivotally connected to vertical rollers

51 and 52 by means of a sleeve 57. The rollers 51 and 52 act as upper weight bearing rollers which run on the upper surface of the transverse web 41. The rollers 51 and 52 are rotatably connected to side frames 53 and 54 and further rollers 55 and 56 are rotatably mounted between the members 53 and 54 and spaced apart by a sleeve (not shown) connected to the sleeve 57 by a plate. The rollers 51, 52, 55 and 56 are thus held in a carriage which can pivot vertically with respect to the plate 30.

The members 53 and 54 are connected at each of the rollers to transverse rollers 60, which roll on the outer edges of the web 41 so as to prevent swivelling of the chassis on the rail. The members 53 and 54 are further connected to pairs of rollers 62 at each corner so as to prevent the chassis from lifting off the rail.

The lower end of the strut 35 is provided with a rotatable roller 64 which rolls on the upper surface of the lower web 42. A transverse roller 66 runs on the outer edge of the web 42. This arrangement provides additional guidance and prevents the chassis from tipping in the plane of the web 40, the weight of the chassis and a chair or other support maintaining the roller 64 in contact with the web 42.

In order to adapt the chassis to the rail at a particular location, the height of the roller 64 and the toothed wheel 44 are set by adjusting the vertical positions of the struts 34 to 36 with respect to the plate 30 and clamping the struts in position by means of the brackets 31 to 33. This may be set during manufacture in accordance with measurements made at the site and/or adjustments may be made when the rail has been installed so as to ensure that the plate 30 remains horizontal for movement throughout the length of the rail. Thus, the spacing between the rollers 51 and 52 and the roller 64

and the toothed wheel 44 is set equal to the spacing between the webs 41 and 42 for horizontal rail sections, which distance depends on the inclination of the inclined rail sections.

Figures 6 and 7 shows a curved rail section which may be used with the orientation shown in Figures 6 and 7 in place of the curved section comprising the members 20 and 21 or vertically inverted in place of the members 10 and 11 as shown in Figure 1. The curved rail section of Figures 6 and 7 differs in that it comprises a prefabricated unit formed by upper and lower transverse webs 70 and 71 which are welded to first and second upright webs 72 and 73 to form a prefabricated unit. A narrow anti-tilt strip 74 is welded to the upright web 72 and a double-width rack 75 is welded to the lower transverse web 71.

The transverse webs 70 and 71 have straight and curved portions which are substantially identical to the corresponding transverse web of the members 20 and 21 shown in Figure 1. However, the curved section differs in that it is selected from a plurality of curved sections which differ from each other by the angle sub-tended by the curved portion of each of the transverse webs 70 and 71. Thus, the prefabricated curved sections are made in a plurality of sizes with adjacent sizes differing from each other such that the rack 75 on the lower transverse web 71 has an integral number of teeth which, in turn, means that the ends of the rack finish at the same point in the tooth cycle for each of the different curved sections. For a rack 75 having teeth of sufficient strength for this application, it has been found that adjacent sizes of the curved section have curved transverse web portions which differ from each other by 2° with the racks differing from each other by one tooth.

Figure 8 shows a level rail part which is particularly suitable for being curved in a horizontal plane so as to guide the carriage around landings between flights of stairs which are in different vertical planes. This part of the rail comprises three flat webs 80, 81, and 82 spaced apart by spaces 83 and 84 which are fixed to the webs. Irrespective of the inclination of the or each adjacent flight of stairs, each spacer 83 may be of the same height since the vertical spacing between the webs 80 and 81 is the same for any installation. However, the vertical spacing between the webs 81 and 82 varies according to the inclination of the or each adjacent flight of stairs and depends on the curved rail sections which are required. Thus, each spacer 84 is selected from a plurality of spacers of different predetermined heights corresponding to the different prefabricated curved sections.

Figure 9 shows a horizontal straight rail section comprising upper and lower transverse webs 90 and 91 connected together by one or more upright webs 92. Again, the vertical spacing between the transverse webs 90 and 91 is the same for all installations so that this part of the horizontal straight section can be formed in a single size.

The section shown in Figure 9 further comprises a transverse web 93 connected to and spaced from the transverse web 90 by a plurality of spacers 94. The vertical spacing between the transverse webs 90 and 93 varies, depending on the installation, as described with reference to Figure 8, so that each spacer 94 is selected to give the correct vertical spacing for the particular installation from a plurality of spacers of predetermined heights.

In Figures 8 and 9, the rack is omitted for clarity. The

webs 81 and 90 perform the anti-tilt function of the strip 74 in Figures 6 and 7.

Figure 10 shows part of a carriage or chassis which is similar to that shown in Figures 3 to 5 but is modified so as to cooperate with the strip 74 and the rack 75 of the rail sections shown in Figures 6 to 9. Like reference numerals refer to like parts which will not be described further. The chassis is shown on an inclined rail section having a lower transverse web 100 connected to an upper transverse web 101 by upright webs 102 and carrying the rack 75. The anti-tilt strip 103 extends downwardly from the upper transverse web 101.

The roller 64 rolls between the upper surface of the lower transverse web 100 and the anti-tilt strip 103 so as to prevent tilting of the chassis about a horizontal axis transverse to the longitudinal axis of the rail. The toothed pinion 44 on the output shaft of the gearbox 39 engages the toothed rack 75 for propelling the chassis along the rail.

The chassis carries a rechargeable battery (not shown) for powering the motor 38. Further, the chassis has contacts (not shown) connected to the battery and arranged to cooperate with contacts fixed to either or both ends of the rail. The fixed contacts are connected to a power supply for supplying battery recharging current and are arranged to cooperate with the contacts on the chassis when the chassis is at either or both ends of the rail so as to permit automatic recharging of the battery. Thus, the need for cables connected to the moving chassis for supplying power thereto is eliminated.

It is thus possible to provide a rail and chassis which can be readily adapted to any particular stairlift location and can accommodate different inclinations and

directions of flights of stairs and landings. The rail and the chassis may be made from standard components which may be adjusted during manufacture or on site and may be altered for subsequent relocation at a different site. Cost of manufacture and installation is therefore substantially reduced compared with known stairlifts, which have to be custom-designed and manufactured for each specific location.

CLAIMS

1. A rail for a stairlift, comprising a first rail portion for guiding a chassis along a curved path having a first angle of inclination at a first end of the path and a second angle of inclination, different from the first angle of inclination, at a second end of the path, characterised in that the first rail portion has an upper member attached to a lower member, the upper member having an upper curved transverse web (14, 70) and the lower member having a lower curved transverse web (12, 71).

2. A rail as claimed in Claim 1, characterised in that the curves of the upper and lower curved transverse webs (14, 70; 12, 71) are circular and subtend the same angle.

3. A rail as claimed in Claim 1 or 2, characterised in that at least one of the upper and lower members has a straight transverse web extending tangentially from one end of the respective curved transverse webs (14, 70; 12, 71).

4. A rail as claimed in any one of the preceding claims, characterised in that the upper and lower members have respective upright webs (10, 11, 20, 21) which are attached to each other so as to permit adjustment of relative position.

5. A rail as claimed in any one of Claims 1 to 3, characterised in that the upper and lower curved transverse webs (70, 71) are connected together by two upright webs (72, 73).

6. A rail as claimed in any of the preceding claims,

characterised by a second rail portion (4) having upper and lower webs (5, 6) extending linearly and tangentially from the upper and lower curved transverse webs (12, 14) at the first end of the first rail portion.

7. A rail as claimed in any one of the preceding claims, characterised by a third rail portion having upper and lower webs extending linearly and tangentially from the upper and lower curved transverse webs (12, 14) at the second end of the first rail portion.

8. A rail as claimed in Claim 7, characterised in that the second angle of inclination is zero and the third rail portion comprises upper and lower members attached to each other.

9. A rail as claimed in Claim 8, characterised in that the upper and lower members of the third rail portion have upright webs (16, 17) attached together so as to permit the relative heights thereof to be adjusted.

10. A rail as claimed in any one of Claims 7 to 9, characterised in that the third rail portion is transversely curved.

11. A stairlift characterised by comprising a rail as claimed in any one of the preceding claims and a chassis supported on and guided by the rail.

12. A stairlift as claimed in Claim 11, characterised in that the chassis has at least one upper roller (51, 52) for rolling on the upper transverse web, at least one lower roller (64) for rolling on the lower transverse web, and means (31 - 36) for adjusting the relative heights of the upper and lower rollers (51, 52; 64).

13. A stairlift as claimed in Claim 11 or 12,

characterised in that the chassis has a toothed wheel (44) cooperating with a rack (43, 75) on the rail for propelling the chassis along the rail.

14. A stairlift as claimed in Claim 13, characterised in that the toothed wheel is connected via a reduction gearing (39) to an electric motor (38), the chassis carries a rechargeable electric battery for powering the motor (38), and the chassis and the rail have contact means for cooperating together when the chassis is at a predetermined position on the rail to permit the supply of recharging current to the battery.

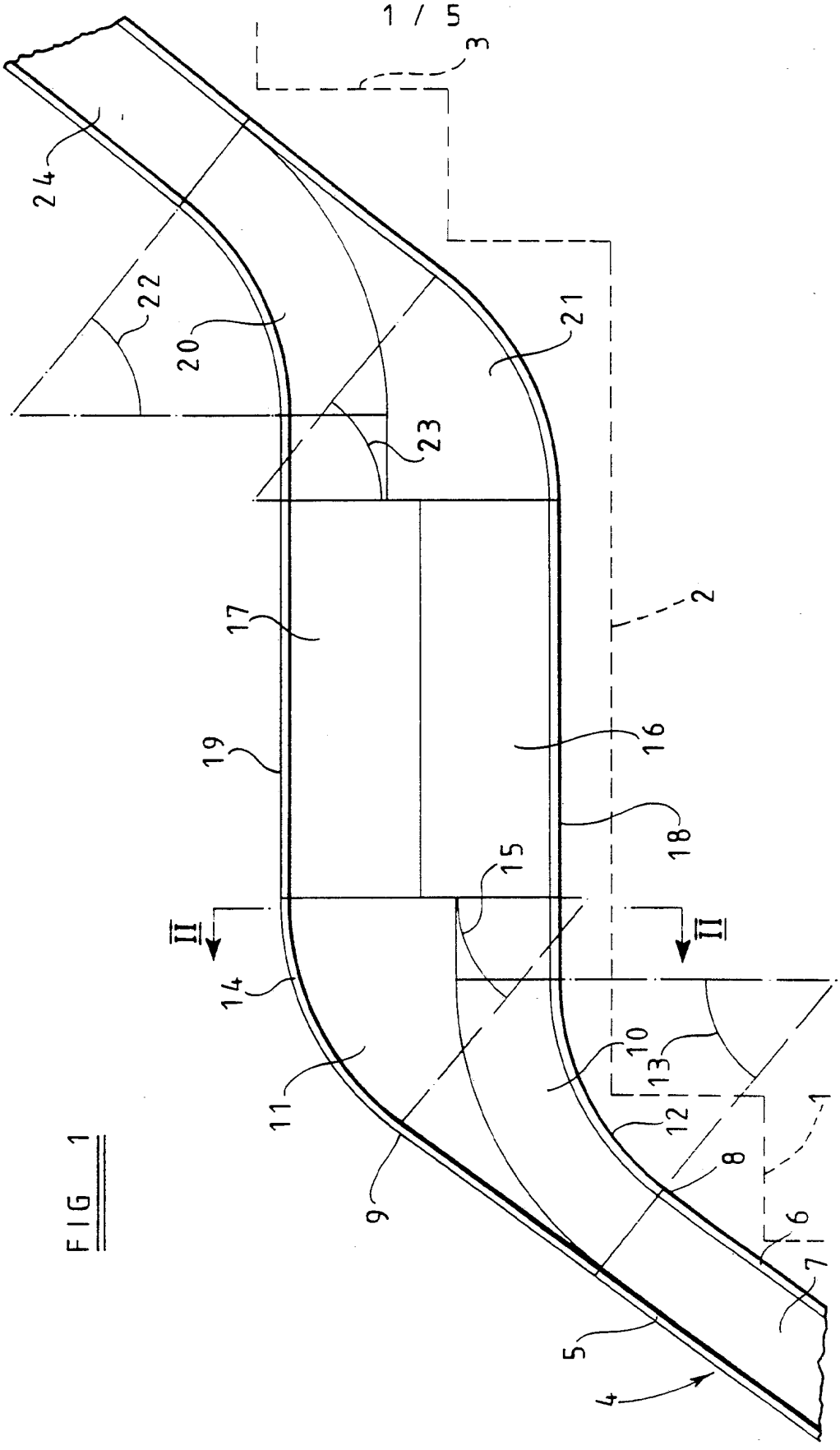

FIG 1

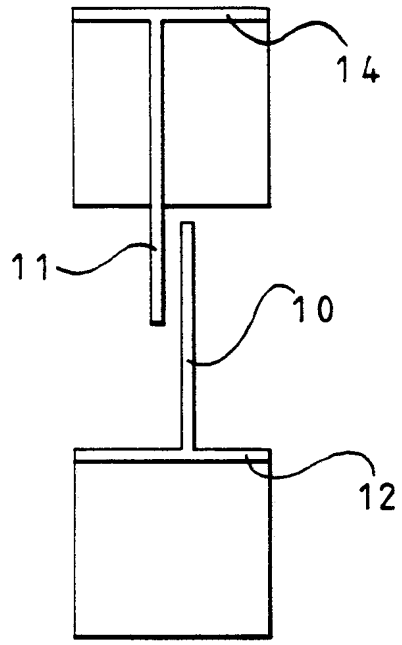
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FIG 2

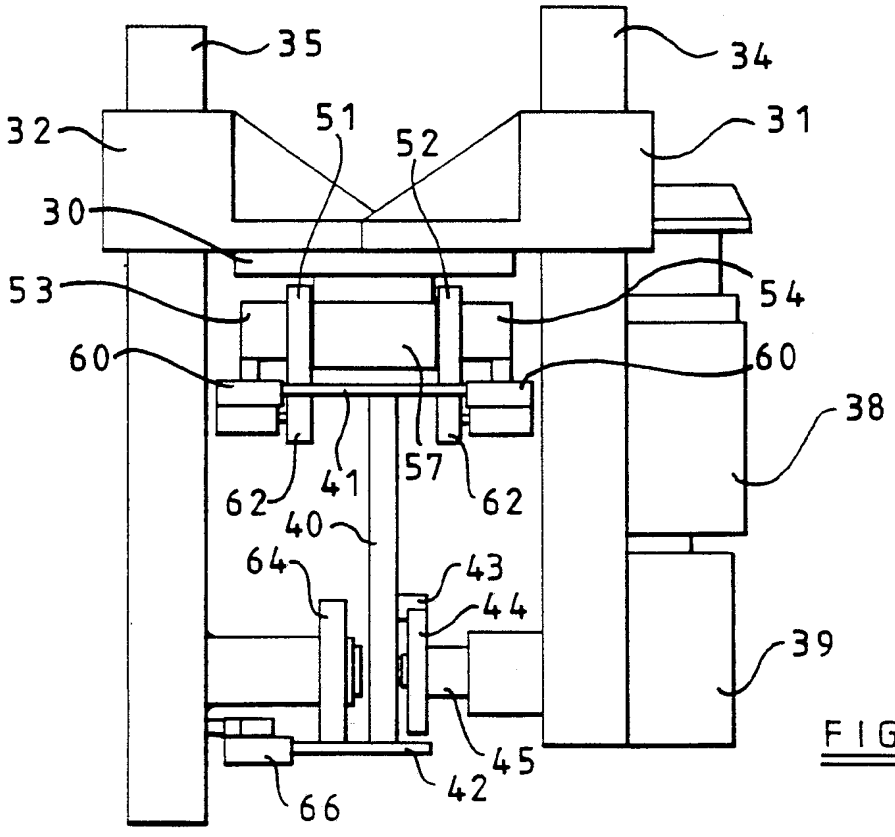
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FIG 3

FIG 4

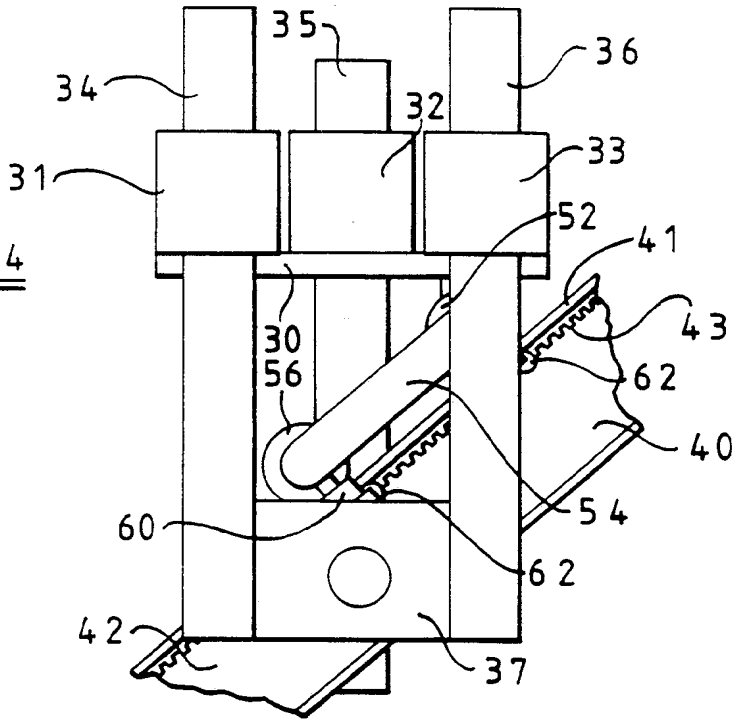
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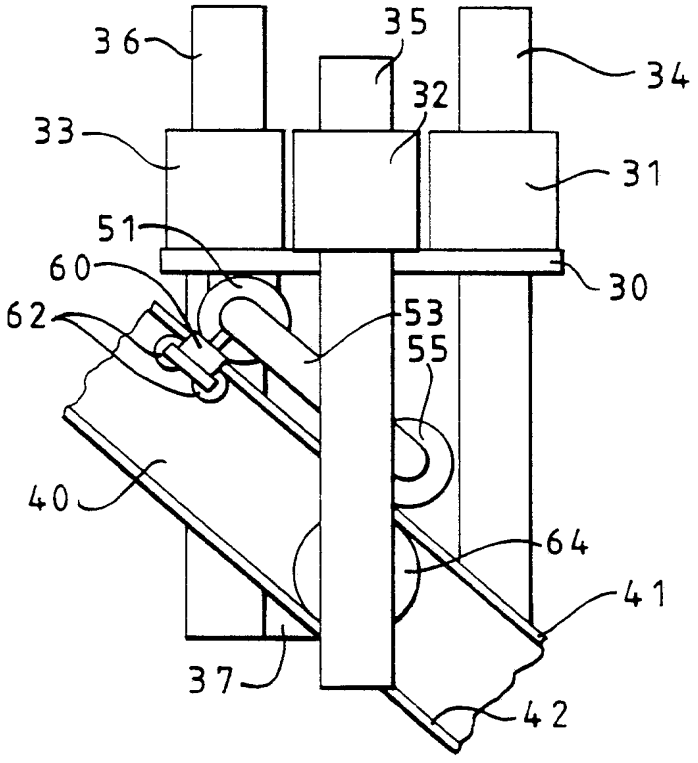
FIG 5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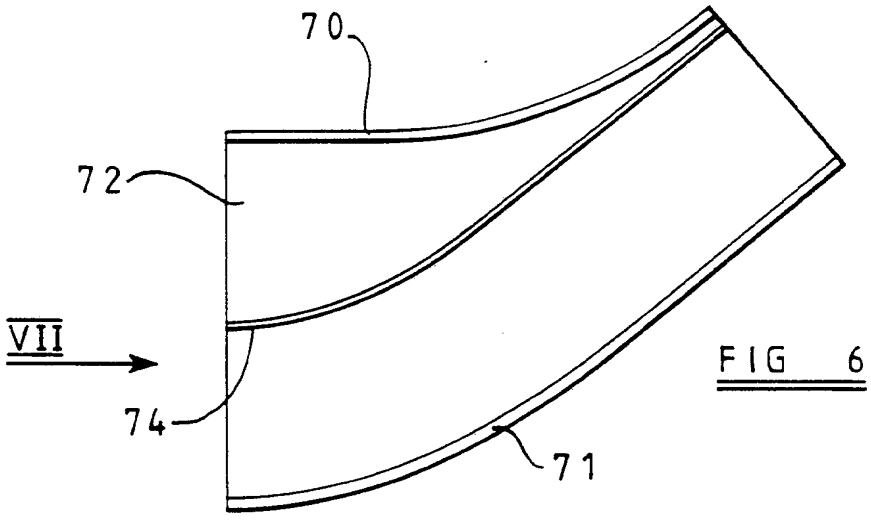


FIG 6

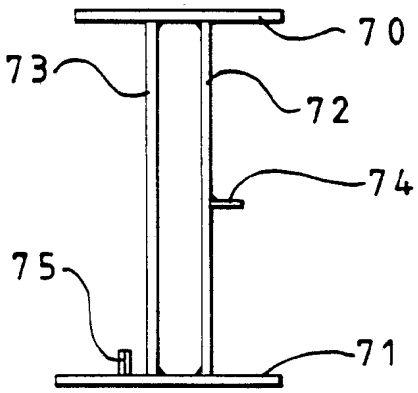


FIG 7

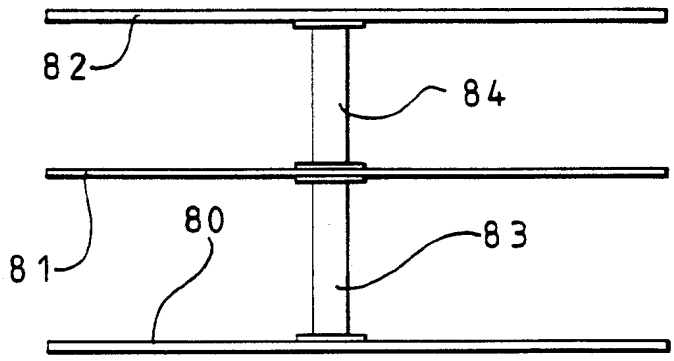


FIG 8

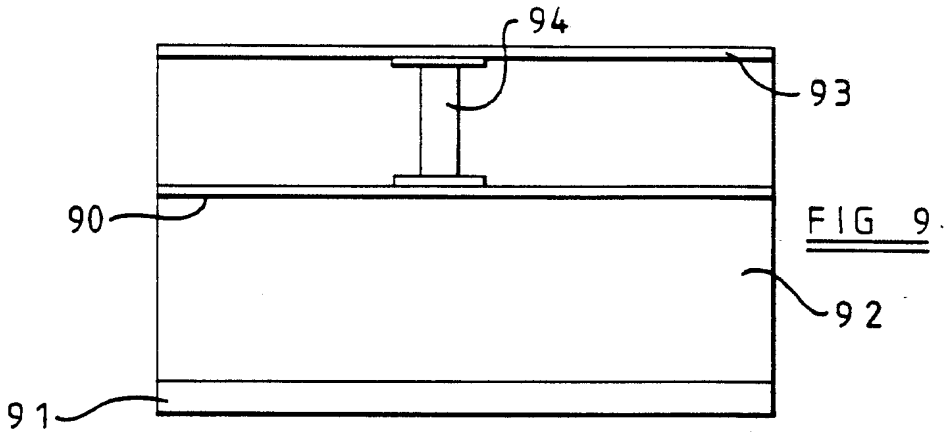
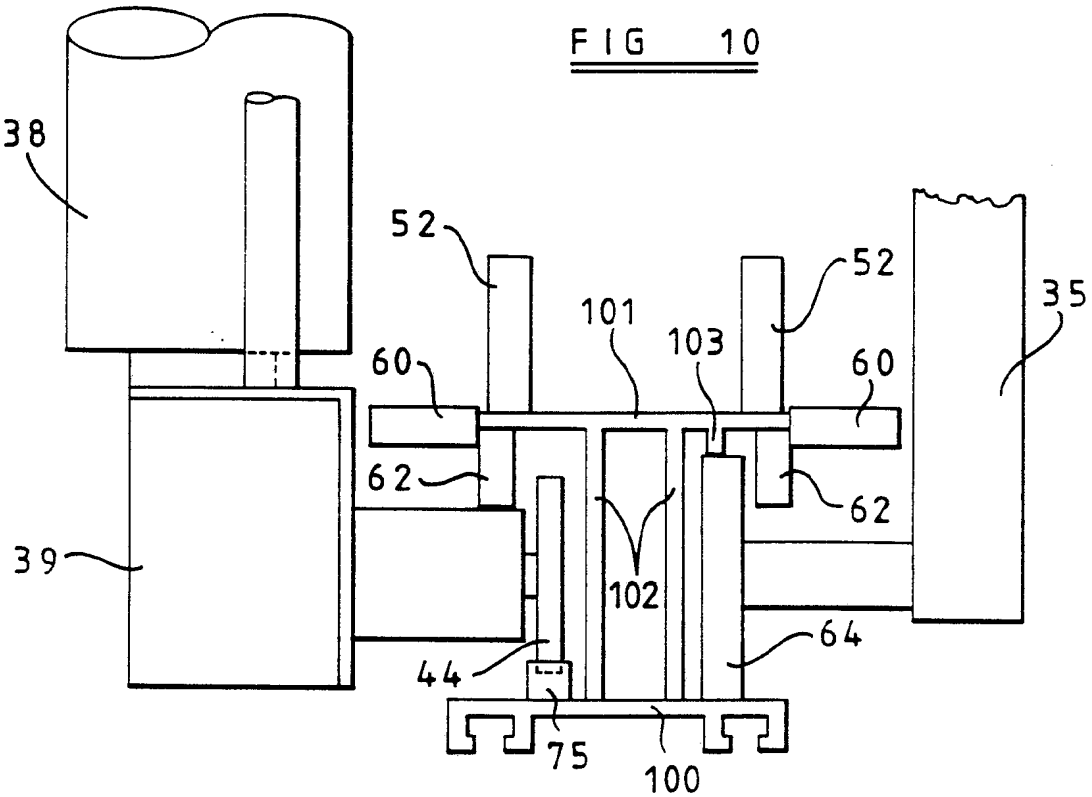


FIG 9

FIG 10



INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 92/00918

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B66B9/08

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	B66B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category[10]	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	DE,A,3 819 522 (KLEINDIENST GMBH) 14 December 1989 see column 3, line 16 - column 4, line 31; figures 1-3 ---	1,11-14
A	DE,A,2 434 009 (STEINERT ELEKTROMAGNETBAU) 5 February 1976 see page 7, line 15 - page 10, line 28; figures 1-5 ---	1,11-13
A	EP,A,0 019 014 (GRASS, GERD) 26 November 1980 see page 6, line 4 - page 8, column 20 see page 9, line 25 - page 11, line 23; figures 1-5 ---	7-9

[10] Special categories of cited documents :

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24 AUGUST 1992	02. 09. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	CLEARY F.M. Fidelma Cleary

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 9200918 SA 59528

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 24/08/92
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
DE-A-3819522	14-12-89	None		
DE-A-2434009	05-02-76	None		
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